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FATAL INTRAOPERATIVE DISSECTION OF THE INNOMINATE ARTERY DUE TO PERFUSION THROUGH THE RIGHT AXILLARY ARTERY

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Several studies concerning the advantage of axillary artery cannulation during cardiovascular surgery have been published.[1-4] We also have used this method successfully in 42 cases of acute aortic dissection since 1997. However, one serious complication has occurred, as reported herein.

Clinical summary. A 70-year-old man had an acute Stanford type A aortic dissection and obstruction of the right common iliac artery by the flap, for which he underwent an emergency operation. The blood pressure was equal in both arms, and no flap was detected in the bilateral carotid and subclavian arteries. A 10-mm graft was sutured to the right axillary artery, which was free from dissection, and was used as an arterial inflow for extracorporeal circulation (ECC). Because of a large intimal tear in the aortic arch, the ascending aorta and the proximal portion of the aortic arch were replaced. During distal anastomosis with circulatory arrest, the innominate artery was gently clamped near its origin and cerebral perfusion through the axillary artery was performed briefly. Circulatory arrest time was 33 minutes. Transesophageal echocardiography showed a narrowed true lumen of the thoracic aorta, which remained almost unchanged throughout the operation. After ECC was stopped, the conditions of the anastomotic sites and the formerly pulseless right femoral artery were carefully checked first, and protamine was administered. About 25 minutes later, the right axillary artery was found to be pulseless. An ascending aorta–right axillary artery bypass was then performed, but revascularization took 45 minutes after ECC was stopped. Subtotal infarction of the right cerebral hemisphere, including the whole perfusion area of the right carotid artery, occurred, and the patient died 2 weeks later. The left hemisphere and the perfusion area of the basilar artery were intact. Autopsy revealed a circumferential intimal tear in the innominate artery, close to its bifurcation into the right carotid and subclavian arteries, and obstruction of the true lumen just distal to the tear (Fig 1). The dissection involved the whole right cervical carotid artery, but the right subclavian and axillary arteries were intact. The aorta was found to have been repaired satisfactorily.

Discussion. Brain protection during aortic arch repair is a major concern. Selective or retrograde cerebral perfusion is our standard method of choice. In patients with slightly prolonged circulatory arrest, we sometimes perform low-flow cerebral perfusion, usually briefly, through the right axillary artery, which is routinely used as an arterial inflow. Although not the optimal method, it is easily performed just by clamping the innominate artery and without the need for additional cannulas, which would be obstructive.[1,2]

In the present case, ischemia occurred in the ipsilateral cerebral hemisphere, whereas the contralateral hemisphere was well preserved. Therefore, the main problem was not the method of brain protection during deep hypothermia, but the dissection of the innominate artery and its tardy diagnosis. Because there was no sign of this dissection preoperatively, we believe that it developed or markedly worsened intraoperatively because of the retrograde perfusion from the right axillary artery. A small re-entry might already have existed. Clamping the innominate artery was another possible cause, but the clamp site appeared to be remote from the tear. Because of its distance from the aortic arch, the tear was not discovered during the repair of the aorta or by intraoperative transesophageal echocardiography, and this potentially fatal condition could not be diagnosed during ECC. However, had we noticed the tear soon after ECC was stopped, we could have restarted ECC and established an extra-anatomic bypass. Instead, we noticed the tear very late, after infusion of protamine. It must be emphasized that reconfirmation of good pulsation in all accessible arteries, especially arteries that supply the brain, is the first priority after the termination of ECC during surgery for aortic dissection.

Some surgeons prefer to reposition the arterial inflow site from the peripheral artery to the aortic graft during rewarming. However, repositioning demands caution in cases in which the axillary artery is used. In this case, the right cerebral hemisphere was also well perfused so long as ECC through the axillary artery was continued, and malperfusion developed when ECC was stopped. Another striking aspect was that brain malperfusion may have developed just after such repositioning and been masked by the nonpulsatile ECC flow, resulting in death. This unfortunate eventuality suggests that the cerebral blood supply must be monitored, continuously and bilaterally, during all operations for aortic dissections.[2,5]

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Fig 1. Autopsy findings (left side is cranial). A circumferential intimal tear *(large black arrow)* is visible near the bifurcation of the innominate artery into the right carotid and subclavian arteries *(white arrow).* Thrombus *(small arrows)* existed in the false lumen just distal to this tear. The prosthetic graft (bottom) was the ascending aorta–right axillary artery bypass, which was established on an emergency basis.

The optimal choice of the arterial inflow site during operations for type A aortic dissection is controversial. This type of dissection sometimes precludes cannulation even of the femoral or iliac arteries, let alone of the aorta. We usually use the right axillary artery in conjunction with the femoral artery to guard against possible malperfusion phenomena,[1,6] and we perform cerebral perfusion through the axillary artery when necessary. Of 42 patients treated, this was the only patient in whom a serious complication developed due to this method. Left axillary artery cannulation[4] may be unlikely to cause the complications encountered in the present case. However, another type of malperfusion may develop in some patients, because an intimal tear is often present around the origin of the left subclavian artery. Thus, axillary artery cannulation is a very good method, but no arterial inflow site is always safe or reliable in the presence of acute aortic dissection. The site has to be determined and the cannula has to be repositioned whenever necessary, with appropriate intraoperative monitoring of organ perfusion, especially that of the brain, in each individual case.

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